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IS 10048 (1999): Rice grader [FAD 20: Agriculture and Food Processing Equipments]

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(दूसरा पुनरीक्षण)

Indian Standard

RICE GRADER — SPECIFICATION

(Second Revision)

ICS 67.060; 53.100

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

January 1999 **Price Group 3**

Agricultural Produce Processing and Milling Machinery Sectional Committee, FADC 51

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards after the draft finalized by the Agricultural Produce Processing and Milling Machinery Sectional Committee had been approved by the Food and Agriculture Division Council.

With the modernization of rice milling industry in the country, rice graders are being increasingly used and manufactured. In order to maintain and evaluate the quality of the grader, this standard was first published in 1981 and revised in 1987. In order to include various safety parameters, moisture content of test material for performance requirement and updating of referred standards, a need was felt to revise it again.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

RICE GRADER — SPECIFICATION

(Second Revision)

1 SCOPE

1.1 This standard specifies material, constructional performance and other requirements of rice grader.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
210 : 1993	Grey iron castings (*fourth revision*)
277 : 1992	Galvanized steel sheet (plain and corrugated) (*fifth revision*)
399 : 1963	Classification of commercial timbers and their zonal distribution
816 : 1969	Code of practice for use of metal arc welding for general construction in mild steel (*first revision*)
2062 : 1992	Steel for general structural purposes (*fourth revision*)
2266 : 1989	Steel wire ropes for general engineering purposes (*third revision*)
2405 (Part 1) : 1980	Industrial sieves : Part 1 Wire cloth sieves (*first revision*)
2405 (Part 2) : 1980	Industrial sieves : Part 2 Perforated plates (*first revision*)
4333 (Part 2) : 1977	Methods of analysis for foodgrains : Part 2 Moisture
7283 : 1992	Hot rolled bars for production of bright bars and machined parts for engineering applications (*first revision*)

3 TERMINOLOGY

3.0 For the purpose of this standard, the following definitions shall apply.

3.1 Bran

The powdered material obtained from the outermost part of the brown rice (*see* **3.3**).

3.2 Broken Rice

Rice kernels which are broken and whose length is less than 3/4 of the original length.

3.2.1 *Large/Big Brokens*

Rice kernels of less than 3/4 of the size of whole grain in length but bigger than medium broken.

3.2.2 *Medium Brokens*

Rice kernels of less than 1/2 of the size of whole grain in length but bigger than small/fine broken.

3.2.3 *Small/Fine Brokens*

Rice kernels of less than 1/4 and bigger than 1/8 of the size of whole grain in length.

3.2.4 *Total Brokens*

The sum total of the small, medium and large brokens.

3.3 Brown Rice (Dehusked Rice)

Paddy from which husk only has been removed.

3.4 Feed Mechanism

The mechanism which feeds the rice into the rice grader and regulates feed rate.

3.5 Gyrosifter

A grader in which head rice and brokens are separated by screening after passing them over a set of gyrating screens. Rotary flat sieve could also be used for grading.

3.6 Head Rice

Rice grains of size 3/4 and above in length, of a whole rice grain.

3.7 Indented Disc Grader

A grader in which head rice is separated from brokens which are picked up in the indents provided on a set of revolving discs.

3.8 Indented Drum Grader

A grader in which indents are formed in a cylindrical drum which revolves slowly and picks up brokens and thus separates them from rice mass. It is also known as trieur cylinder.

3.9 Polished Rice/Milled Rice

The rice from which the bran layers have been fully/ partially removed by polishing.

3.10 Rice Grader

A machine which is used for grading polished rice into head rice and broken rice.

3.11 Screen

Perforated sheet with round or slotted holes, or wire mesh used for separating brokens from rice mass.

3.12 Sieve Aspirator

A rice grader which separates brokens from rice mass by means of vibrating screens in conjunction with air stream. The traces of bran adhering to head rice and brokens are separated by an aspirator.

4 TYPES

4.1 The rice grader shall be of following types:

a) Indented Type
  i) Indented disc type (*see* Fig. 1),
  ii) Indented drum type (*see* Fig. 2).
b) Sieve Type
  i) Sieve aspirator type (*see* Fig. 3),
  ii) Gyrosifter type (*see* Fig. 4).

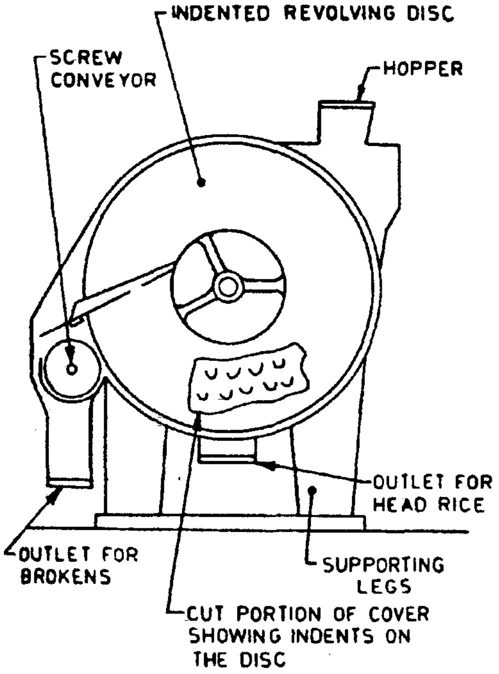

FIG. 1 INDENTED DISC TYPE GRADER

5 MATERIAL

5.1 The material of construction of main components of the different types of graders shall be declared by the manufacturer in the operator's manual. The material may be selected from following depending upon usage:

a) Cast iron (*see* IS 210)

b) Mild steel (*see* IS 2062)

c) Wood (*see* IS 399)

d) Galvanized steel sheet (*see* 277)

e) Wire mesh [*see* IS 2405 (Part 1)]

f) Steel wire rope (*see* IS 2266)

g) Carbon steel (*see* IS 7283)

6 PERFORMANCE REQUIREMENTS

6.1 When tested in accordance with the method given in Annex A, the separators shall conform to the following requirements:

a) The grader shall meet the requirement given in **A-3.1**.

b) The input capacity of the rice per kWh energy used shall be not less than 1 250 kg. The capacity shall be declared by the manufacturer (*see* **A-4.4**).

c) The grader shall withstand the test given in **A-5.1**.

7 CONSTRUCTIONAL REQUIREMENTS

7.1 Frame shall be made of suitable size mild steel angle section or wood and shall be provided with proper bracings.

7.2 Hopper shall be provided with a feed regulating device capable of distributing the feed evenly to the grader.

7.3 One or two oscillating and/or rotary screens, depending on the size of the grader, shall be used.

7.4 Blower shall be provided with a control to regulate air flow rate.

7.5 Suitable system for transmitting the power shall be provided. It may consist of V-belt and pulley, gears or sprocket and chain.

7.5.1 Transmission guards shall be provided to prevent accidental contact of persons or parts of clothing being caught in the transmission system, unless the system is so constructed or placed as to be safe without guards.

7.5.2 The guards shall be so designed as not to hinder

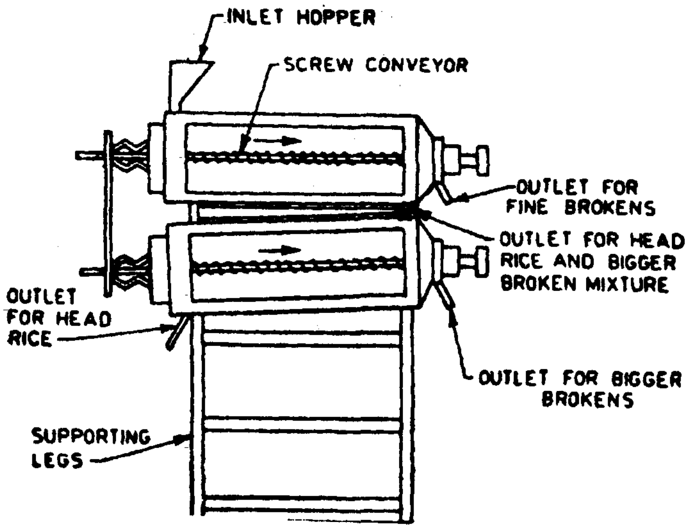

FIG. 2 INDENTED DRUM TYPE GRADER

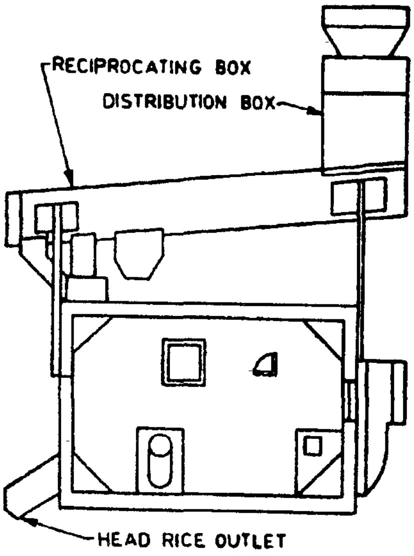

FIG. 3 SIEVE ASPIRATOR

in easy adjustment, servicing and operation of grader.

7.5.3 It is preferable that all guards shall be either permanently attached or firmly secured to prevent their removal without the aid of tools. The servicing and adjustments should be possible without complete removal of the guards.

7.5.4 The guards shall have sufficient strength to support load of 1 200 N applied at any point over an area of 0.1 m^2 without permanent set.

NOTE — Depending upon space available, the area and load may be correspondingly increased or decreased for testing purposes.

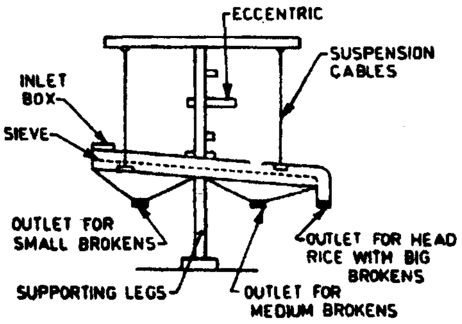

FIG. 4 GYROSIFTER

7.6 The shafts and eccentrics shall be supported on ball or roller bearings at both the ends.

8 OTHER REQUIREMENTS

8.1 The axle shaft shall be finished to close tolerances at the bearings and shall be properly aligned.

8.2 Provisions shall be made for lubrication of bearing and these shall be dust proof.

8.3 Various controls shall be easily accessible and capable of being locked at selected position.

8.4 Operational and maintenance manual along with safety instructions shall be supplied by the manufacturer.

8.5 In case of belt drive, provision for belt tighting shall be made.

8.6 Provision for cleaning the screen and to avoid clogging shall be provided.

9 WORKMANSHIP AND FINISH

9.1 The components of the graders shall be free from cracks, pits, holes and other visual defects which may be detrimental for their use.

9.2 The welding, if done, shall not be porous and shall be smooth (*see* IS 816).

9.3 A protective coating against rusting shall be applied on the steel components.

10 MARKING AND PACKING

10.1 Marking

Each grader shall be marked with the following particulars:

- a) Manufacturer's name, address and his recognized trade-mark, if any;
- b) Batch or code number;
- c) Power rating and capacity;
- d) Type;
- e) Mode No.;
- f) Year of manufacturing;
- g) Grading effectiveness (*see* **A-4.5**);
- h) Performance index (*see* **A-4.6**); and
- j) Direction of rotating parts.

10.1.1 A minimum cautionary notice worded as follows shall be written in *vernacular* language legibly and prominently on the main body of the grader:

- a) DO NOT WEAR LOOSE DRESS, BANGLES, WATCH, ETC, WHILE WORKING;
- b) DO NOT WORK UNDER THE INFLUENCE OF INTOXICANTS LIKE LIQUOR, OPIUM, ETC;
- c) CHILDREN AND AGED PERSONS SHOULD BE DISCOURAGED FOR WORKING ON GRADER;
- d) DO NOT CROSS OVER MOVING BELTS;
- e) DO NOT OPERATE GRADER WITHOUT GUARDS AND SAFETY DEVICES;
- f) DO NOT MAKE ADJUSTMENT WHEN GRADER IS WORKING; AND
- g) DO NOT PUT OR TAKE-OFF BELT WHILE PULLEY IS RUNNING.

10.2 BIS Certification Marking

The grader may also be marked with the Standard Mark.

10.2.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

10.3 Packing

The packing of the grader shall be done as agreed to between the purchaser and the supplier for safe handling in transit.

ANNEX A

(*Clause* 6.1)

METHODS OF TEST FOR RICE GRADERS

A-1 TEST MATERIAL

A-1.1 Sufficient quantity of polished rice of the same variety shall be taken. The percentage of head rice and brokens shall be analyzed by taking 5 samples each of 100 g and the average shall be reported. The brokens present in the feed shall be in the range of 25 percent to 50 percent.

A-1.2 The moisture content of test material when measured in accordance with IS 4333 (Part 2) shall be 14 percent, *Max*.

A-2 RUNNING-IN AND PRELIMINARY ADJUSTMENTS

A-2.1 The grader shall be installed on level and preferably on hard surface. All the adjustments shall be made in accordance with the manufacturer's recommendation.

A-2.2 The grader shall be attached with a suitable prime mover preferably with an electric motor and auto-voltage stabilizer. An energy meter or some form of transmission dynamometer shall be fitted. The power delivered to the grader may be supplied in the following ways:

a) Direct coupling the prime mover with the main shaft of the grader, and

b) Connecting the prime mover with the help of a flat or V-belt and pulleys with the main shaft of the grader.

A-2.2.1 In case of (a), the power delivered to the grader would be the power output of the prime mover; whereas in case of (b), the allowances for flat and V-belt drive losses may be taken at 6 percent and 3 percent respectively.

A-2.3 The grader shall be run-in without load before commencing the tests. The running-in shall be carried out in accordance with the manufacturer's recommendation. In the absence of any recommendation by the manufacturer, the grader shall be run-in for 30 minutes. During the period of run-in, adjustment for various functional components may be done. All the adjustments done shall be in accordance with the instructions contained in the manual supplied by the manufacturer.

A-3 TEST AT NO LOAD

A-3.1 After the running-in is over, the grader shall be run at no load for 30 min at the specified speed. During and after no load run, the visual observation of the grader shall not show the following:

a) Presence of any marked vibration during the operation,

b) Presence of undue knocking or rattling sound,

c) Frequent slippage of belts,

d) Any marked unusual wear or slackness in any component, and

e) Any marked rise in bearing temperature.

A-4 TEST AT LOAD

A-4.1 Operation and Collection of Data

The grader shall be operated at its specified speed for 15 min at a feed rate slightly below the rated input capacity specified by the manufacturer. During the run period, collect the following samples and data:

a) Three sets of samples of graded fractions like brokens and head rice at an interval of 5 min at each outlet.

b) The speed of the main shaft and the reading of the energymeter or dynamometer shall be recorded.

A-4.1.1 At the end of 15 min feeding, run the grader for sometime so that practically no more material already fed comes out. At the end of the test, collect and weigh the material.

A-4.1.2 The test given at **A-4.1** and **A-4.1.1** shall be repeated for minimum of three times at various feed rates covering approximately 90 percent, 100 percent and 110 percent of rated input capacity declared by the manufacturer.

NOTE — For the purpose of certification, the test at **A-4.1** and **A-4.1.1** shall be conducted at the capacity declared by the manufacturer and test at **A-4.1.2** need not be conducted.

A-4.2 Preparation and Analysis

Three samples of different fractions of graded materials shall be analyzed for brokens and head rice percentage.

A-4.3 Determination of Energy Consumption

The energy requirement for each feed rate shall be calculated in accordance with **A-4.3.1** and **A-4.3.2**.

A-4.3.1 In case of prime mover fitted with an energymeter, the readings taken shall be the energy consumption for 5 min. The energy consumption per hour giving due allowance to the type of drive shall be calculated and reported.

A-4.3.2 In case of prime mover fitted with the dynamometer, the readings taken shall indicate the torque required. The energy consumption giving due allowance to the type of drive (*see* **A-2.2.1**) shall be determined after computing power delivered by primemover by the following formula:

$$P = \frac{T \times S}{973.363}$$

where

P = power delivered by primemover, kW;
T = torque, Nm; and
s = speed, rev/min.

A-4.4 Determination of the Rated Input Capacity

Select the feed rate at which the following requirements are met. The capacity in terms of energy consumed shall be calculated by dividing the capacity by energy consumed (*see* **A-4.3**):

a) It shall be able to remove 20 percent brokens present in the feed in one pass, and

b) Percentage of head rice in total brokens shall not be more than 5 percent.

A-4.5 Grading Effectiveness

A-4.5.1 Grading effectiveness shall be computed using Mc Cabe Smith's formula as given below:

$$E = \frac{(X_f - X_b)(X_d - X_f)X_d(1 - X_b)}{(X_d - X_b)^2(1 - X_f)X_f}$$

where

X_f = mass fraction of head rice in feed ,
X_d = mass fraction of head rice in overflow, and
X_b = mass fraction of head rice in underflow.

A-4.6 Performance Index

A-4.6.1 Performance index shall be computed as follows:

$$\text{PI} = \frac{\text{Capacity} \times \text{Grading effectiveness}}{\text{Power}}$$

A-5 LONG RUN TEST

A-5.1 The grader shall be operated for a minimum period of 20 h at no load which could be covered by continuous run of atleast 5 h. During and after the operation, no breakdown or defect shall develop in the grader.

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